

SPECULATIONS
ON THE
PERCEPTIVE POWER
OF
VEGETABLES:

ADDRESSED TO THE
LITERARY AND PHILOSOPHICAL SOCIETY
OF MANCHESTER.

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SPECULATIONS ON THE PERCEPTIVE POWER OF VEGETABLES.

- - - These are not idle, philosophic dreams ;
Full Nature *teems* with life. - - -

THOMSON'S Spring, Second Edit. line 136.*

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IN all our enquiries into truth, whether natural or moral, it is necessary to take into previous consideration, the kind of evidence which the subject admits of ; and the degree of it, which is sufficient to afford satisfaction to the mind. Demonstrative evidence is absolute, and without gradation ; but probable evidence ascends, by regular steps, from the lowest presumption, to the highest moral certainty. A single presumption is, indeed, of little weight ; but a series of such imperfect proofs may produce the fullest conviction. The strength of belief, however, may often be greater, than is proportionate to the force and number of these proofs, either individually or collectively considered. For, as uncertainty is always painful to the understanding, very slight evidence, if the subject

* These lines are omitted in the subsequent editions of Thomson's Seasons.

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be capable of no other, sometimes amounts to credibility. This every philosopher experiences, in his researches into nature; and the observation may serve as an apology for the following *jeu d'esprit*; in which I shall attempt to shew, by the several analogies of organization, life, instinct, spontaneity, and self-motion, that plants, like animals, are endowed with the powers, both of perception and enjoyment.

I. Vegetables bear so near a similitude to animals in their STRUCTURE, that botanists have derived from anatomy and physiology, almost all the terms employed in the description of them. A tree or shrub, they inform us, consists of a cuticle, cutis, and cellular membrane; of vessels variously disposed, and adapted to the transmission of different fluids; and of a ligneous, or bony substance, covering and defending a pith or marrow. Such organization evidently belongs not to inanimate matter; and when we observe, in vegetables, that it is connected with, or instrumental to the powers of growth, of self-preservation, of motion, and of seminal increase, we cannot hesitate to ascribe to them a LIVING PRINCIPLE. And by admitting this attribute, we advance a step higher in the analogy we are pursuing. For, the idea of life naturally implies some degree of perceptivity: And wherever perception resides, a greater or less

less capacity for enjoyment seems to be its necessary adjunct. Indefinite and low, therefore, as this capacity may be, in each single herb or tree, yet, when we consider the amazing extent of the vegetable kingdom, "from the cedar of Lebanon to the hyssop upon the wall," the aggregate of happiness, produced by it, will be found to exceed our most enlarged conceptions. It is prejudice only, which restrains or suppresses the delightful emotions, resulting from the belief of such a diffusion of good. And, because the framers of systems have invented arrangements and divisions of the works of God, to aid the mind in the pursuits of science, we implicitly admit as reality, what is merely artificial; and adopt distinctions, without proof of any essential difference. *Lapides crescunt; vegetabilia crescunt et vivunt; animalia crescunt, vivunt, et sentiunt.* This climax, of Linnæus, is conformable to the doctrines of Aristotle, Pliny, Jungius, and others: But none of these great men have adduced sufficient evidence, to support the negative characteristics, if I may so express myself, on which the three kingdoms of nature are here established. That a gradation subsists, in the scale of beings, is clearly manifest; but the higher advances we make in physical knowledge, the nearer will the degrees be seen to approach each other. And it is no very extravagant conjecture to suppose, that, in some future period, perceptivity

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may be discovered to extend, even beyond the limits now assigned to vegetable life. Corallines, madrepores, millepores, and sponges were formerly considered as fossil bodies: But the experiments of Count Marfigli evinced, that they are endued with life, and led him to class them with the maritime plants. And the observations of Ellis, Jussieu and Peysonel, have since raised them to the rank of animals.* The detection of error, in long established opinions concerning one branch of natural knowledge, justifies the suspicion of its existence in others, which are nearly allied to it: And it will appear, from the prosecution of our enquiry into the instincts, spontaneity, and self-moving power of vegetables, that the suspicion is not without foundation.

II. INSTINCT is a propensity, or movement to seek, without deliberation, what is agreeable to the particular nature, actuated by it; and to avoid what is incongruous, or hurtful. It is a practical power, which requires no previous knowledge or experience; and which pursues a present or future good, without any definite ideas or foresight; and often, with very faint degrees of consciousness. The calf, when it first comes into the world, applies to the teats of the cow, utterly ignorant of the taste, or nutritious quality of the milk, and consequently,

* Consult Philos. Transact. Amœnitat. Academic. and Bishop Watson on the Subjects of Chemistry.

with

with no views, either to sensual gratification, or support: And the duckling, which has been hatched under a hen, at a distance from water, discovers a constant restlessness and impatience; and is observed to practise all the motions of swimming, though a stranger to its future designation, and to the element, for which its oily feathers, and web-like feet, are formed. Instincts analogous to these, operate with equal energy, on the vegetable tribe. A seed contains a *germ*, or plant in miniature, and a *radicle*, or little root, intended by nature to supply it with nourishment. If the seed be sown in an inverted position, still each part pursues its proper direction. The *plumula* turns upward, and the *radicle* strikes downward, into the ground. A hop-plant, turning round a pole, follows the course of the sun, from south to west, and soon dies, when forced into an opposite line of motion: But remove the obstacle, and the plant will quickly return to its ordinary position. The branches of a honey-suckle shoot out longitudinally, till they become unable to bear their own weight; and then strengthen themselves, by changing their form into a spiral: When they meet with other living branches, of the same kind, they coalesce, for mutual support, and one spiral turns to the right, and the other to the left; thus seeking, by an instinctive impulse, some body on which to climb, and increasing

the probability of finding one, by the diversity of their course: For if the auxiliary branch be dead, the other iniformly winds itself round, from the right to the left.*

These examples, of the instinctive œconomy of vegetables, have been purposely taken from subjects, familiar to our daily observation. But the plants of warmer climates, were we sufficiently acquainted with them, would probably furnish better illustrations of this acknowledged power of animality: And I shall briefly recite the history of a very curious exotic, which has been delivered to us from good authority; and confirmed by the observations of several European botanists.

The *Dionæa Muscipula* is a native of North Carolina. Its leaves are numerous, inclining to bend downwards, and placed in a circular order: They are jointed, and succulent: The upper joint consists of two lobes, each of which is semi-oval in its form, with a margin furnished with stiff hairs; which embrace each other, when they close from any irritation. The surfaces of these lobes are covered with small red glands, which probably secrete some sweet liquor, tempting to the taste, but fatal to the lives of insects: For, the moment the poor animal alights upon these parts, the two lobes rise up,

* Lord Kaimes's Gentleman Farmer.

grasp it forcibly, lock the rows of spines together, and squeeze it to death: And, lest the struggles for life should disengage the insect, thus entangled, three small spines are fixed amongst the glands, near the middle of each lobe, which effectually put an end to all its efforts: Nor do the lobes open again, while the dead animal continues there. The dissolution of its substance, therefore, is supposed, by naturalists, to constitute part of the nourishment of the plant. But as the discriminative power of instinct is always limited, and proceeds with a blind uniformity when put into exertion, the plant closes its leaves as forcibly, if stimulated by a straw or a pin, as by the body of an insect: Nor does it expand them again, till the extraneous substance is withdrawn.*

III. If the facts and observations, which have been adduced, furnish any presumptive proof of the instinctive power of vegetables, it will necessarily follow, that they must be endued with some degree of SPONTANEITY. For the impulse to discriminate and to prefer, is an actual exertion of that principle, however obscure the consciousness or the feeling may be, with which it is accompanied: And such volition presupposes an innate perception, both of what is consonant, and of what is injurious to the constitution of the individual, or species directed by it. But

* See the Annual Register for 1775, p. 93.

it is the design of this little Essay, rather to investigate nature, than to appeal to metaphysical considerations : I shall proceed, therefore, to point out a few of those phenomena, in the vegetable kingdom, which indicate spontaneity.

Several years ago, whilst engaged in a course of experiments to ascertain the influence of fixed air on vegetation, the following fact repeatedly occurred to me. A sprig of mint, suspended by the root, with the head downwards, in the middle glass vessel of Dr. Nooth's machine, continued to thrive vigorously, without any other pabulum, than what was supplied by the stream of mephitic gas, to which it was exposed. In twenty-four hours, the stem formed into a curve, the head became erect, and gradually ascended towards the mouth of the vessel ; thus producing, by successive efforts, a new and unusual configuration of its parts. Such exertions in the sprig of mint, to rectify its inverted position, and to remove from a foreign, to its natural element, seems to evince volition to avoid what was evil, and to recover what had been experienced to be good. If a plant, in a garden-pot, be placed in a room, which has no light, except from a hole in the wall, it will shoot towards the hole, pass through it into the open air, and then vegetate upwards, in its proper direction. Lord Kaims relates, that, " amongst the ruins of New Abbey, formerly a
" monastery

“ monastery in Galloway, there grows on the
“ top of a wall, a plane tree, twenty feet high.
“ Straited for nourishment, in that barren
“ situation, it several years ago directed roots
“ down the side of the wall, till they reached
“ the ground, ten feet below: And now, the
“ nourishment it afforded to these roots, during
“ the time of descending, is amply repaid;
“ having every year, since that time, made vi-
“ gorous shoots. From the top of the wall, to
“ the surface of the earth, these roots have not
“ thrown out a single fibre, but are now united
“ into a pretty thick hard root.”*

The regular movements, by which the sun-
flower presents its splendid disk to the sun, have
been known to naturalists, and celebrated by
poets, both of ancient and modern times. Ovid
founds upon it a beautiful story; and Thomson
describes it as an attachment of love, to the
celestial luminary.

“ But one, the lofty follower of the sun,
“ Sad when he sets; shuts up her yellow leaves,
“ Drooping all night; and when he warm returns,
“ Points her enamour'd bosom to his ray.”

Summer, line 216.

IV. Nature has wisely proportioned the
POWERS of MOTION, to the diversified necessities
of the beings endued with them. Corallines
and Seapens are fixed to a spot, because all their

* Gentleman Farmer

wants may be there supplied. The oyſter, during the afflux of the tide, opens to admit the water, lying with the hollow ſhell downwards: But when the ebb commences, it turns on the other ſide; thus providing, by an inconfiderable movement, for the reception of its proper nutriment; and afterwards diſcharging what is ſuperfluous.* Mr. Miller, in his late account of the iſland of Sumatra, mentions a ſpecies of coral, which the inhabitants have miſtaken for a plant, and have denominated it Lalan—Cout, or ſea-graſs. It is found in ſhallow bays, where it appears like a ſtraight ſtick, but when touched, withdraws itſelf into the ſand.† Now, if ſelf-moving faculties, like theſe, indicate animality, can ſuch a diſtinction be denied to vegetables, poſſeſſed of them in an equal, or ſuperior degree? The water-lily, be the pond deep or ſhallow in which it grows, puſhes up its flower-ſtems, till they reach the open air, that the farina fecundans may perform, without injury, its proper office. About ſeven in the morning, the ſtalk erects itſelf, and the flowers riſe above the ſurface of the water: In this ſtate they continue till four in the afternoon, when the ſtalk becomes relaxed, and the flowers ſink and cloſe. The motions of the ſenſitive plant have been long

* Sprat's Hiſtory of the Royal Society.

† Philoſoph. Tranſact. vol. LXVIII. p. 178.

noticed

noticed with admiration, as exhibiting the most obvious signs of perceptivity. . And if we admit such motions, as criteria of a like power, in other beings, to attribute them, in this instance, to mere mechanism, actuated solely by external impulse, is to deviate from the soundest rule of philosophizing, which directs us not to multiply causes, when the effects appear to be the same. Neither will the laws of electricity better solve the phenomena of this animated vegetable: For its leaves are equally affected by the contact of electric, and non-electric bodies; shew no change in their sensibility, whether the atmosphere be dry or moist; and instantly close when the vapour of volatile alkali, or the fumes of burning sulphur are applied to them. The powers of chemical stimuli, to produce contractions in the fibres of this plant, may perhaps lead some philosophers, to refer them to the *vis insita*, or irritability, which they assign to certain parts of organized matter, totally distinct from, and independent of, any sentient energy. But the hypothesis is evidently a solecism, and refutes itself. For the presence of irritability can only be proved by the experience of irritations, and the idea of irritation involves in it that of feeling.

But there is a species of the order of Decandria, which constantly and uniformly exerts a self-moving power, uninfluenced either by chemical stimuli, or by any external impulse whatsoever.

This

This curious shrub, which was unknown to Linnæus, is a native of the East Indies, but has been cultivated in several botanical gardens here. I had an opportunity of examining it, in the collection of the late Dr. Brown. It is trifolious, grows to the height of four feet, and produces, in autumn, yellow flowers. The lateral leaves are smaller than those at the extremity of the stalk; and all day long, they are continually moving either upwards, downwards, or in the segment of a circle: The last motion is performed by the twisting of the foot stalks; and whilst one leaf is rising, its associate is generally descending: The motion downwards is quicker and more irregular, than the motion upwards, which is steady and uniform. These movements are observable, during the space of twenty-four hours, in the leaves of a branch lopped off from the shrub, and kept in water. If, from any obstacle, the motion be retarded, upon the removal of that obstacle, it is resumed with a greater degree of velocity.* I cannot better comment on this wonderful degree of vegetable animation, than in the words of Cicero. *Inanimum est omne quod pulsu agitur externo; quod autem est animal, id motu cietur interiore et suo.*

I have thus attempted, with the brevity prescribed by the laws of this Society, to extend

* See Encyclopædia Britannica, Art. Hedyfarum.

our views of animated nature; to gratify the mind with the contemplation of multiplied accessions to the general aggregate of felicity; and to exalt our conceptions of the wisdom, power, and beneficence of God. In an undertaking, never yet accomplished, disappointment can be no disgrace: In one, directed to such noble objects, the motives are a justification, independently of success. Truth, indeed, obliges me to acknowledge, that I review my speculations with much diffidence; and that, I dare not presume to expect they will produce any permanent conviction in others, because I experience an instability of opinion in myself. For to use the language of Tully, *Nescio quomodo, dum lego assentior; cum posui librum, assensio omnis illa elabitur.*—But this scepticism is perhaps to be ascribed to the influence of habitual preconceptions, rather than to a deficiency of reasonable proof. For besides the various arguments which have been advanced, in favour of vegetable perceptivity, it may be further urged, that the hypothesis recommends itself, by its consonance to those higher analogies of nature, which lead us to conclude, that the greatest possible sum of happiness exists in the universe. The bottom of the ocean is overspread with plants, of the most luxuriant magnitude. Immense regions of the earth are covered with perennial forests. Nor are the Alps, or the Andes, destitute of herbage,
though

though buried in depths of snow. And can it be imagined, that such profusion of life subsists without the least sensation or enjoyment? Let us rather, with humble reverence, suppose, that vegetables participate, in some low degree, of the common allotment of vitality: And that our great Creator hath apportioned good, to all living things, "in number, weight, and measure." *

SUPPLEMENT to the foregoing PAPER; containing further Observations on the SENSITIVE PLANT.

IN the speculations, concerning the perceptive power of vegetables, which were read before this Society last spring, I observed, that the motions of the sensitive plant are not to be explained by the laws of electricity. For its leaves are alike affected by the contact of electric and non-electric bodies; shew the same sensibility whe-

* It has been estimated, that our globe contains 20,000 species of vegetables; 3000 of worms; 12,000 of insects; 200 of amphibious animals; 2,600 of fishes; 550 of birds; and 200 of quadrupeds. (Vid. Linn. Amœnit. Academ. and Stillingfleet's Miscellaneous Tracts, p. 125). A calculation like this, it is evident, must be very defective; because founded on past discoveries in a science, which is now in a state of rapid progression. But future accessions, both of plants and animals, with respect to number, may produce no material changes in their relative proportions.

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ther the atmosphere be dry or moist; and instantly close when certain chemical stimuli, such as the vapour of vol. alkali, or the fumes of burning sulphur, are applied to them. These conclusions were founded on the recollection of experiments which I made more than twenty years ago. But the Abbè Barthalon de St. Lazane, in a late treatise on the electricity of vegetables, has adopted an opposite hypothesis, and adduced the following trials in support of it. When the sensitive plant, says he, is touched with a piece of polished metal, terminated at each end by a round knob, its leaves shrink back and shut. When it is touched with a piece of glass, of the same form, it remains insensible. But if this piece of glass be electrified, and the plant be touched with it in this state, the leaves instantly close themselves. Hence he infers, that the plants called *Mimosa* are endued with a much greater portion of electrical fluid than others; that this fluid escapes when touched by a foreign body, capable of conveying it away; and that they shrink by being thus deprived of what is essential to their health and vigour.*

I have lately procured a sensitive plant, with the design of repeating the Abbè's experiments.

* See Abbè Barthalon de St. Lazane *D'Electricité des Vegetaux*: Also Appendix to Monthly Review, vol. XVII. p. 135.

But at the present season of the year, I find this vegetable in a very languid state; so that my trials have not afforded me much satisfaction. I could not, however, perceive any difference, whether the leaves were touched with a piece of polished iron, or a stick of sealing wax. And the following well authenticated facts, seem to refute the Abbè's hypothesis, concerning the electrical œconomy of this plant.

I. The branches of the sensitive plant have two motions, the one natural, the other artificial. By the first it progressively increases, in the morning, the angle which it forms with the stem; and retreats in the same gradual manner, in the afternoon. By the second it contracts its leaves, when forcibly touched or shaken.

II. The sensibility of the plant, seems chiefly to reside in the articulation of the branches of the common foot stalk, or of the particular foot stalk of each wing.

III. No motion ensues from cautiously piercing the branch with a needle, or other sharp instrument.

IV. A stroke, or an irritation produces a more forcible effect, than an incision or even an entire section.

V. A slight irritation only acts upon the neighbouring parts, and extends its influence according to its force.

VI. Plung-

VI. Plunging the plant in water seems to have no other effect, than that of diminishing its vigour.

VII. A piece of wax, strongly electrified, made the leaves of the sensitive plant close quickly, by attracting them to it with considerable force.

VIII. The motions of the sensitive plant are owing to a strong contraction. Each foot stalk seems to be terminated with a kind of joint, on which the leaves turn, with surprizing facility.*

NOVEMBER 9, 1784.

* Consult Milnes's Botanical Dictionary ; the Encyclopædia Britannica ; and Whytt on Vital Motions.

T H E E N D.



